



**UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/199,829	11/25/98	SMITH	P TI-25250

MARK A VALETTI  
TEXAS INSTRUMENTS INCORPORATED  
PO BOX 655474  
MS 3999  
DALLAS TX 75265

MM92/0428

EXAMINER

EATON, K

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 04/28/00

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

<b>Office Action Summary</b>	Application No. <span style="float: right;">Applicant(s)</span> 09/199,829 <span style="float: right;">SMITH ET AL.</span>	
	Examiner Kurt M Eaton	Art Unit 2823
	-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address -- <b>Period for Reply</b> A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION. <ul style="list-style-type: none"> <li>- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.</li> <li>- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.</li> <li>- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.</li> <li>- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).</li> </ul>	

**Status**

1) ☒ Responsive to communication(s) filed on 25 November 1998.

2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4) ☒ Claim(s) 1-24 is/are pending in the application.

4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

6) ☒ Claim(s) 1-24 is/are rejected.

7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.

8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on 25 November 1998 is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. § 119**

13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some \* c) ☐ None of the CERTIFIED copies of the priority documents have been:

1. ☐ received.

2. ☐ received in Application No. (Series Code / Serial Number) \_\_\_\_\_.

3. ☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

**Attachment(s)**

14) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) 15) <input checked="" type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) 16) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____	17) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ 18) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) 19) <input type="checkbox"/> Other: _____
---	--

Art Unit: 2823

## DETAILED ACTION

### *Drawings*

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, figures depicting the method of claims 20-24 (i.e., at least figures depicting forming a dielectric layer on a first conductor, wherein the dielectric layer has at least one opening which exposes then first conductor; forming a layer of an oxygen sensitive material on the dielectric layer, wherein the oxygen sensitive material substantially fills the opening in the dielectric layer and provides electrical contact to the first conductor; forming a photoresist layer on the oxygen sensitive material on the dielectric layer, wherein the photoresist layer has a pattern so as to expose portions of the oxygen sensitive material; removing the exposed portions of the oxygen sensitive material on the dielectric material, wherein the removal step causes a residue to be formed on exposed surfaces of the remaining portions of the oxygen sensitive material; and removing the photoresist layer by subjecting the photoresist layer with a hydrogen containing gas incorporated into a plasma) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

### *Specification*

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification is objected to under 37 CFR 1.73, 1.75 because:

Art Unit: 2823

The SUMMARY OF THE INVENTION from pages 4 to 6 is essentially a verbatim copy of the claims. This does not meet the objectives of the summary in 37 CFR 1.73 which states that "A brief summary of the invention indicating its nature and substance, which may include a statement of the object of the invention, should precede the detailed description." A further elaboration of this is given in MPEP 608.01(d) which states "Since the purpose of the brief summary of invention is to apprise the public, and more especially those interested in the particular art to which the invention relates, of the nature of the invention, the summary should be directed to the specific invention being claimed. That is, the subject matter of the invention should be described in one or more clear, concise sentences or paragraphs." Claims are written in legal language to specify in broad terms the legal limitations of the invention, and are not intended to provide technical information to the public about the nature of the invention.

The first paragraph of 35 U.S.C. 112 states that "The specification shall contain a written description of the invention, and of the manner an process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains". The legal language utilized for claims to set the metes and bounds of the patent protection does not fulfill this requirement. In addition, 37 CFR 1.75 (d) sets up the criteria that the specification is a dictionary for the claims and should provide clear support or antecedent basis for all terms used in the claims. Since the SUMMARY OF THE INVENTION merely duplicates the claims, it is not providing support for the claims.

The second paragraph of 35 U.S.C. 112 states that "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the

Art Unit: 2823

applicant regards as his invention". Since the claims are given at the end of the specification, it is redundant and superfluous to include them as part of the summary.

Since rules 37 CFR 1.73 and 37 CFR 1.75 clearly identify the SUMMARY OF THE INVENTION as a section which is separate and distinct from the CLAIMS and the other sections, the intended objective was not to provide an exact copy of the claims in the SUMMARY.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. The term "higher" in claim 3 is a relative term which renders the claim indefinite. The term "higher" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The limitation rendered indefinite the relative term "higher" is the limitation "wherein said step of removing said photoresist layer is performed by subjecting said semiconductor wafer to a higher temperature step which is conducted in a hydrogen ambient with ...".

Art Unit: 2823

*Claim Rejections - 35 USC § 103*

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1 and 7-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao et al.

In re claim 1, Zhao et al. (herein referred to as Zhao) shows, in an analogous art related to the field of plasma cleaning integrated circuit devices, in Figures 1-4 providing a semiconductor wafer; forming a layer of a first material (12) over a substrate (10) which is patterned; and subjecting the semiconductor wafer to a plasma which incorporates a gas which includes hydrogen or deuterium so as to remove residue from the first material. Zhao also teaches that, within the prior art, it is common to provide a first layer of patterned material over a substrate by providing the first layer of material as a metal containing material and patterning the first layer by: forming a photoresist layer over the first layer wherein the photoresist layer has a pattern so as to expose portions of the layer of first material, patterning the layer of the first material by removing the exposed portions of the first material so as to form a conductive structure, and removing the photoresist layer after patterning the layer of the first material {column 1, lines 10-63; column 2, line 58 – column 3, line 55}.

It would have been obvious to one of ordinary skill in the art at the time the invention was made that the invention of Zhao had to have been an extension of the prior art disclosed within

Art Unit: 2823

Zhao since Zhao states the need arising from the prior art disclosed within its specification.

Therefore, Zhao discloses: forming a layer of a first material over the substrate, wherein the first material is a metal containing material; forming a photoresist layer over the layer of the first material; patterning the layer of the first material; removing the photoresist layer after patterning the layer of the first material; and subjecting the semiconductor wafer to a plasma which incorporates a gas which includes hydrogen or deuterium so as to remove residue from the first material.

Zhao does not show wherein the first material is oxygen sensitive material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made that metal material is an oxygen sensitive material in that oxygen can react with metal and form a metal oxide and therefore the first material of Zhao would obviously be an oxygen sensitive material.

In re claims 8 and 10-19, Zhao substantially discloses the invention as claimed but fails to show wherein the layer of first material is selected from the group including: Cu, Ti, TiN, W, WN, Al, AlCu alloy, Ag, Au, or any combination thereof.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the layer of first material of Zhao out of Cu, Ti, TiN, W, WN, Al, AlCu alloy, Ag, Au, or any combination thereof since it is well known within the art that materials made of Cu, Ti, TiN, W, WN, Al, AlCu alloy, Ag, Au, or any combination thereof may be used in the formation of patterned metal structures formed through photoresist patterning techniques and the selection of a known material on the basis of its suitability for the intended use involves only routine skill in the art. Furthermore, the specification contains no disclosure of either the critical nature of the claimed material or any unexpected results arising therefrom. Where patentability is said to be based upon

Art Unit: 2823

particular chosen materials or upon another variable recited in a claim, the applicant must show that the particular materials are critical.

8. Claims 2-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Hause et al..

In re claims 2-4, Zhao substantially discloses the invention as claimed but fails to show wherein the step of removing the photoresist layer is performed by subjecting the semiconductor wafer to the same plasma used to remove the residues and at a temperature around 245 °C.

Hause et al. (herein referred to as Hause) teaches, in an analogous art related to a method of forming low resistance contact structures in vias which are configured between interconnects arranged on two separate topological levels, that after an etching procedure using a photoresist material as a patterned mask is completed, wherein the etching procedure translates the pattern of the photoresist to material underneath it, an etch byproduct polymer residue is formed on exposed surfaces of the underlying material. The etch byproduct polymer residue is an organic material derived from the photoresist layer. Hause also teaches removing the photoresist layer after the etching procedure is carried out by subjecting the device to a plasma which incorporates a gas which includes hydrogen or deuterium, and then removing the etch byproduct polymer residue using the same gas used to remove the photoresist {column 5, lines 21-64}.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the photoresist and the residue material of Zhao using plasma of Hause since the plasma of Hause can remove both photoresist material and residue material and employing the plasma of Hause to remove both the photoresist and residue material of Zhao in lieu of performing



Art Unit: 2823

the two photoresist and residue material removal techniques of Zhao would reduce the complexity of the process and increase the throughput of the fabrication process.

Zhao in view of Hause still does not show wherein the photoresist is removed at a temperature of around 245 °C.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the photoresist of Zhao in view of Hause at a temperature of around 245 °C since temperature control is a well known processing variable that may be controlled and monitored during a plasma etching process and the discovery of an optimum or workable temperature range applied during a plasma etching step involves only routine skill in the art. Furthermore, the specification contains no disclosure of either the critical nature of the claimed temperature range or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen temperature ranges or upon another variable recited in a claim, the applicant must show that the particular temperature ranges are critical.

In re claims 5 and 6, Hause shows wherein the gas additionally includes a forming gas of nitrogen {column 5, line 35-64}.

9. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao as applied to claim 1 and Zhao in view of Hause as applied to claims 2-6, and 8, above, and further in view of Chen et al.

Zhao in view of Hause substantially discloses the invention as claimed but fails to show wherein the patterned first material of metal containing material is formed in an opening within a dielectric layer overlying a first conductor, wherein the first material substantially fills the opening within the dielectric layer.

Art Unit: 2823

Chen et al. (herein referred to as Chen) shows, in an analogous art related to a method of making integrated circuits on semiconductor substrates, Figures 8 and 9 forming a dielectric layer (22) on a first conductor (16), wherein the dielectric layer has at least one opening (24) which exposes the first conductor; and forming a layer of an oxygen sensitive material (26) on the dielectric layer, wherein the oxygen sensitive material substantially fills the opening in the dielectric layer and provides electrical contact to the first conductor and patterning the oxygen sensitive material {column 6, line 50 – column 7, line 26}.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the patterned first material of Zhao in view of Hause such that it substantially filled an opening within a dielectric layer overlying a first conductor as in Chen since the conductive structure of Chen would allow selective electrical contact to semiconductor devices to be made. Furthermore, the specification contains no disclosure of either the critical nature of the claimed conductive structure or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen conductive structures or upon another variable recited in a claim, the applicant must show that the particular conductive structures are critical.

10. Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Hause and Chen as applied to claim 20 above, and further in view of Fujimura et al..

Zhao in view of Hause and Chen substantially discloses the invention as claimed but fails to show wherein the step of removing the residue is conducted by subjecting the residue to a fluorinated etchant which includes  $\text{CF}_4$  or  $\text{CHF}_3$ .

Art Unit: 2823

Fujimura et al. (herein referred to as Fujimura) teaches, in an analogous art related to oxidizing organic material such as a photoresist, that a fluorinated etchant including either  $\text{CF}_4$  or  $\text{CHF}_3$  gases may be used to remove organic material {column 5, line 13 – column 6, line 13}.

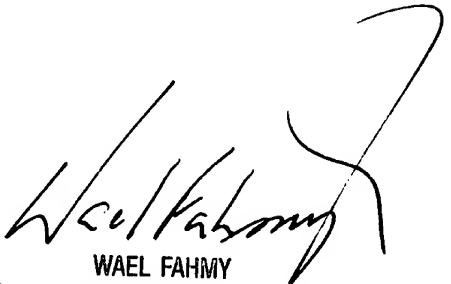
It would have been obvious to one of ordinary skill in the art at the time the invention was made to remove the residue formed in the invention of Zhao in view of Hause and Chen using etchant gases containing either  $\text{CF}_4$  or  $\text{CHF}_3$  as in Fujimura since a photoresist residue is an organic material and, as evidenced by Fujimura, etchant gases containing either  $\text{CF}_4$  or  $\text{CHF}_3$  are known within the art to remove organic material and the selection of a known material on the basis of its suitability for the intended use involves only routine skill in the art. Furthermore, the specification contains no disclosure of either the critical nature of the claimed etchant gases or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen etchant gases or upon another variable recited in a claim, the applicant must show that the particular etchant gases are critical.

### *Conclusion*

11. Paper related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 4C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is (703) 308-7722 or -7724. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Art Unit: 2823

Any inquiry concerning this communication of earlier communication from the examiner should be directed to **Kurt Eaton** at (703) 305-0383 and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via [kurt.eaton@uspto.gov](mailto:kurt.eaton@uspto.gov).



Wael Fahmy  
WEL FAHMY  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800